

Site Need Statement

General Reference Information	
1 *	Need Title: Glass Monolith Surface Area
2 *	Need Code: RL-WT016
3 *	Need Summary: A method is needed to estimate the surface area of vitrified low-activity waste (LAW). The contaminant release rate from glasses is proportional to the surface area reachable by moving moisture. As glass cools it experiences internal stresses and strains, which may cause the glass to crack and hence increase the surface area on the glass. External stresses (for example, those caused by earthquakes) could also increase surface area. In addition, cracks may expose imperfections in waste form (internal gas pockets, nucleation sites, and devitrification regions), which may cause increased contaminant release rates. Relatively little is known about the long-term behavior of such cracks. Yet the total contaminant release must be known (or at least estimated) for thousands of years.
4 *	Origination Date: FY 2000
5 *	Need Type: Technology Need
6	Operation Office: Office of River Protection (ORP)
7	Geographic Site Name: Hanford Site
8 *	Project: Disposal PBS No: RL-TW09
9 *	National Priority: ___ 1. <u>High</u> - Critical to the success of the EM program, and a solution is required to achieve the current planned cost and schedule. <u>X</u> 2. <u>Medium</u> - Provides substantial benefit to EM program projects (e.g., moderate to high life-cycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays). ___ 3. <u>Low</u> - Provides opportunities for significant, but lower cost savings or risk reduction, may reduce the uncertainty in EM program project success.
10	Operations Office Priority:
Problem Description Information	
11	Operations Office Program Description: The River Protection Project's Project Organization upgrades the SST and DST System for continued safe storage and receipt of radioactive waste as well as the design, construct and operate the immobilized waste storage and disposal facilities. Activities include transferring waste to waste treatment facilities, maintaining and evaluating operating and surveillance systems necessary for compliance with regulatory and AA/AB requirements, identifying if systems are reliable for this mission, transferring waste within the SSTs and DSTs to manage the limited available space; characterizing waste to understand its properties, and developing flow sheets for waste treatment. The overall purpose of the Disposal function is to provide and operate permitted facilities to disposal of immobilized low-activity waste (ILAW), store and prepare immobilized high-level waste (IHLW) for offsite shipment, and dispose of secondary waste from the tank farms and waste treatment plant (WTP), including failed melters.
12	Need/Problem Description: The total contaminant release rate from a glass waste form depends not only the intrinsic release rate but also the effective surface area over which that intrinsic release rate is applicable. Technologies are needed to measure the effective surface area (i.e. the total wetted area, including internal cracks, of the glass monolith) as well as the ability to project this quantity as a function of time. This need is described in Section 9.3.2 of the Office of River Protection Preliminary Integrated Technology Plan, DOE-ORP-2001-17, Rev 0.

	<p>Consequences of Not Filling Need: Without data, the performance assessment will use conservative parameters, which would require DOE to set tighter requirements on immobilization product vendors or on disposal facility design, thus increasing costs. Better definition of contaminant release will lead to a performance assessment, which can more easily be defended.</p> <p>Program Baseline Summary (PBS) No.: TW09</p> <p>Work Breakdown Structure (WBS) No.: 5.04.01.03</p> <p>TIP No.: 2005 ILAW PA Data Package</p>
13	<p>Functional Performance Requirements: For typical LLW glass monoliths using a variety of sizes and cooling methods:</p> <ul style="list-style-type: none"> • Determine surface area and crack patterns. • Determine area reachable by moisture. • Accelerate aging and repeat measurements. <p>Determine unsaturated hydraulic properties of fractured and aged specimens.</p> <p>Outsourcing Potential: Methods could support the vitrification technology industry by providing a means to determine total contaminant release rate.</p>
**	<p>Schedule Requirements: A standard method for determining waste form release rate and supporting data is needed to prepare the ILAW product specifications for Phase II of the RPP/ORP outsourcing beginning in approximately 2006.</p>
14	<p>Definition of Solution: meet functional requirements</p>
15 *	<p>Targeted Focus Area: Tanks Focus Area (TFA) and Subsurface Contaminants Focus Area (SCFA)</p>
16	<p>Potential Benefits: Reduce requirements established by performance assessment (which are enforceable through the EM-1 issued Hanford Site Waste Disposal Authorization Statement) on the quality of the ILAW produced by the Waste Treatment Contractor.</p>
17 *	<p>Potential Cost Savings: Possible cost savings could be in the hundreds of millions of dollars, especially if higher waste loadings are allowed.</p>
18 *	<p>Potential Cost Savings Narrative: A better understanding of long-term release might allow DOE to relax requirements for the short-term testing now required under the outsourcing contract. Possible cost savings could be in the hundreds of millions of dollars.</p>
**	<p>Technical Basis: Contaminant release from the waste form is proportional to the surface area reachable by moving moisture. This release rate determines the impact from waste disposal using very slow-release waste forms.</p>
19	<p>Cultural/Stakeholder Basis: Stakeholders are interested in the parameters, which drive environmental impact, rather than the parameters that are specified in a contract and only have a weak relationship to real-life performance. On-site disposal of ILAW results in the largest inventory of radioactive material to be left at the Hanford Site; thus, the waste form for this disposal is of prime concern to stakeholders.</p>
20	<p>Environment, Safety, and Health Basis: As documented in the ILAW performance assessment (approved by EM-1), the long-term contaminant release rate is the driving factor in determining human health and environmental impact from the disposal of the low-activity fraction of the Hanford Site tank waste.</p>
21	<p>Regulatory Drivers: DOE Order 435.1 requires that waste acceptance criteria address chemical and structural stability of waste packages. The same order requires an assessment of long-term public health and safety. Contaminant release rates are an important input to this assessment. Long-term waste form testing is a requirement of the Hanford Site Waste Disposal Authorization Statement issued by EM-1. This effort will also support Washington State permitting requirements under WAC 173-303.</p>
22 *	<p>Milestones: Data Packages for 2005 ILAW PA</p>
23 *	<p>Material Streams: Immobilized Low-Activity Waste (Hanford Site)</p>
24 *	<p>TSD System: ILAW disposal facility</p>
25	<p>Major Contaminants: Not applicable</p>

26	Contaminated Media: Not applicable
27	Volume/Size of Contaminated Media: Not applicable
28 *	Earliest Date Required: FY 2001
29 *	Latest Date Required: September 2008
Baseline Technology Information	
30	Baseline Technology/Process: Conservative extrapolations from 1980's waste forms. Technology Insertion Point(s): 2005 ILAW PA Data Package
31	Life-Cycle Cost Using Baseline:
32	Uncertainty on Baseline Life-Cycle Cost:
33	Completion Date Using Baseline:
Points of Contact (POC)	
34	Contractor End User POCs: F.M. (Fred) Mann, CHG, (509) 372-9204, Fax: (509) 372-9447, frederick_m_mann@rl.gov
35	DOE End User POCs: P.E. (Philip) LaMont, DOE-RL/ORP, (509) 376-6117, Fax: (509) 373-0628, philip_e_lamont@rl.gov ; E.J. (Joe) Cruz, DOE-ORP, 509-372-2606, F/509-373-1313, E_J_Cruz@rl.gov
36**	Other Contacts: Greg Parsons, CH2M Hill Hanford Group, (509) 371-3783, Fax: (509) 371-3510, greg_l_parsons@rl.gov K.A. (Ken) Gasper, CHG, 509-373-1948, F/509-376-1788, Kenneth_A_Ken_Gasper@rl.gov A.F. (Anne-Marie) Choho, NHC, 509-509-372-8280, F/509-373-6382, Anne-Marie_F_Chocho@rl.gov

*Element of a Site Need Statement appearing in IPABS-IS

**Element of a Site Need Statement required by CHG